

The destroyed buildings were, as a rule, of a very unsubstantial character, being mainly ordinary brick dwellings, small stores, and warehouses. The Fort Nelson Building, at 7th and Main streets, is the most notable exception to the general destruction which marked the path of the tornado. This structure is a well-constructed six-story building, and by its greater height than those surrounding it was more exposed to the storm's fury. Despite the fact that it was directly in the storm's track, and that all other houses on either side were wrecked, it escaped with the loss of its windows. The gyratory motion of the tornado is well illustrated in the disposition of the prostrated trees in the parks and in the timber through which it passed before entering the city. In the centre the trees were piled in promiscuous heaps, denoting a tremendous wrenching or twisting force; on the right side the tree tops point almost northeast; those on the left side, nearer due east. Throughout the path of the storm the zone of destruction on the right side is more than twice as wide as that on the left side, and shows a much greater intensity of force.

The Louisville tornado was but one of a group of such storms which occurred in the state that night. The work of investigating them with a view to determining their location and extent was a peculiarly difficult one. Violent atmospheric disturbances were prevalent throughout Kentucky that night, and many correspondents who were unfamiliar with the characteristics of the tornado proper reported the occurrence of such storms, when in reality they were deceived by unusually severe thunder-storms, accompanied by destructive winds. From the mass of testimony received it has been possible to trace, conclusively, the paths of at least five true tornadoes in Kentucky on the night of March 27th. Each of these storms resulted in loss of life and great destruction of property. In Louisville seventy-six persons were killed, two hundred injured, and \$2,500,000 worth of property destroyed. Outside of the city, including Jeffersonville, Ind., thirty persons were killed, fifty injured, and \$1,000,000 worth of property destroyed. That many lives and an immense amount of property on the river were not lost was due entirely to warnings sent out from the Signal Office on the morning of the 27th. Steamboats, coal fleets, and other craft lying in the harbor were secured by double moorings and were thereby enabled to withstand the force of the storm. River men estimate the value of property thus saved at about \$100,000."

Tornadoes were also reported on this date as follows:

A tornado passed northeastward over the southwest part of Webster county, Ky., its path being about thirty-two miles long and one-fourth to three-fourths of a mile wide. Fifteen persons were killed; sixty dwellings and a large number of out-houses destroyed; and property damaged to the extent of about \$200,000. Within a radius of seven miles of Kuttawa,

Lyon Co., Ky., four persons were killed; a number injured; and \$15,000 damage done to property. At Bremen, Muhlenberg Co., Ky., several persons were injured; eight houses were swept away and a large number wrecked or unroofed; and the damage to property was about \$20,000. A report from Marion, Crittenden Co., Ky., states that in that county three persons were killed and eighty injured, and that the loss to property amounted to about \$75,000. At Eddyville, Lyon Co., Ky., two persons were killed, and the loss by damage to property was about \$12,000. Considerable loss of life and destruction of property was also reported in Christian, Laurel, Henry, Trigg, Barren, and Henderson counties, Ky. At Metropolis, Massac Co., Ill., one person was killed; about fifty injured; and the damage to property aggregated about \$150,000. At Poplar Ridge, near Murphysborough, Jackson Co., Ill., two persons were killed, and the loss to property was about \$3,000. At Grand Tower, Jackson Co., Ill., four persons were killed; about sixty injured; and \$40,000 to \$50,000 worth of property was destroyed. A tornado passed northeastward over Olney, Richland Co., Ill., injuring five persons, wrecking thirty-two houses, many stables, and damaging property to the extent of nearly \$50,000. A destructive tornado was reported in the lower part of Pope county, Ill., and a well-defined tornado was reported in Clay county, Ill. Heavy wind storms, generally attended with hail of unusual size, passed over Winnebago, Washington, Union, Randolph, Cook, and Alexander counties, Illinois. Furious storms prevailed over southern Indiana. A tornado passed over the southeastern part of Missouri, killing four persons at Hoff's Station, and injuring several others. In Tennessee the storm was very severe in the western and the northern and southern parts of the middle section of the state. The counties of Sumner and Lincoln seem to have suffered most. In the former several lives and an immense amount of property were lost, and in the latter it was particularly severe in and around the town of Fayetteville, where many buildings were demolished and several lives were lost. In other portions of the state much damage was done to buildings, etc.

## 0 INLAND NAVIGATION.

### 0 FLOODS.

Excessive rainfall over a great part of the vast water-shed between the Alleghany and Rocky Mountains for the first three months of 1890 furnished a surplus of water that the outlets of the lower Mississippi valley could not discharge, and caused one of the greatest floods on record along the lower Mississippi river. At most important points the water was the highest known, but the levees were in better condition than during great floods of preceding years, and many of the more important levees were firm and in good condition at the close of the month. From January to March, 1890, inclusive, the precipitation in the Ohio Valley and Tennessee was about one-half greater, and in the upper Mississippi valley and the west Gulf states about one-fourth greater than the average precipitation in those regions for the months named. In other sections drained by the Mississippi River and its tributaries the precipitation for the period referred to was deficient. The levee system for the protection of land lying along the lower Mississippi river was commenced with the founding of New Orleans, and this work has been carried on as the necessity for protecting the fertile and rapidly improving sections of the lower Mississippi valley from inundation became apparent, and in 1850, by the concentration of national and state resources, the gigantic work of leveeing the Mississippi River northward to southern Missouri was systematically begun. The inadequacy of this great system to afford complete protection during extreme flood conditions was demonstrated during 1858 and 1859, when the water was above the danger-line during one hundred and fifty-nine days, and thirty-two crevasses occurred from the mouth of the Saint Francis River to Bonnet Carre, La. Other

great floods during which levees were broken and considerable sections of country were inundated occurred in the lower Mississippi in 1862, 1874, 1882, and 1884, the overflowed area in 1882 being about thirty thousand square miles.

The following is a list of the crevasses which occurred in the lower Mississippi levees during March, 1890, with the rise and fall and the stage of water at the more important points from which reports have been received:

On the 1st the stage of water at Cincinnati, Ohio, was 57 feet, and the river had risen 15 feet in five days; at Cairo, Ill., the stage of water was 42.2 feet, and the river had risen 8 feet in five days; at Chattanooga, Tenn., the stage of the water was 40 feet, and it had risen 30 feet in five days; at Nashville, Tenn., the stage of water was 47 feet, and it had risen 34 feet in six days; at Saint Louis, Mo., the stage of water was 8.5 feet, and it had been stationary; at Vicksburg, Miss., the stage of the water was 46.3 feet, and at Little Rock, Ark., 19 feet. The gauge reading at New Orleans, La., was 15.5 feet on the 1st and 2d. On the 4th the river reached the danger-line, 34 feet, at Memphis, Tenn. On the 9th a crevasse occurred in Sappington Hook levee, which is situated in Desha Co., Ark., about six miles above Arkansas City. Adjacent plantations were flooded but no loss of life occurred. At the close of the month this crevasse was about six hundred feet wide. The levee at Alsatia, La., about thirty-eight miles above Vicksburg, Miss., also broke. The stage of the water at Vicksburg on this date was 46.9 feet and rising; at Helena, Ark., 43.3 feet and rising. On the 11th the gauge reading at New Orleans, La., was 16.2, the high-water mark of 1874. On the 12th an extensive break occurred in the main levee at Alsatia, La. On

this date the stage of water at Cairo, Ill., was 48.8 feet, and the water had risen 0.5 foot in twenty-four hours, and 1.0 foot in four days. There had been a rise of 7.0 feet at Cincinnati, Ohio, and a rise of 1.0 foot at Saint Louis, Mo., in twenty-four hours, and there had been a fall of 8.0 feet at Chattanooga, Tenn., and a fall of 1.0 foot at Nashville, Tenn. The stage of the water at Memphis, Tenn., was 36.0 feet and rising; at Helena, Ark., 43.4 feet and rising; at Vicksburg, Miss., 47 feet and rising; at Natchez, Miss., 46 feet; at Red River Landing, La., 43.7 feet; at Baton Rouge, La., 34 feet; and at New Orleans, La., 16.2 feet and stationary. The Arkansas River at Little Rock, Ark., was 16.1, a rise of 6.5 in twenty-four hours. On the 13th the river rose to 17 feet on the gauge at New Orleans, La., in the afternoon. This was the highest stage of water ever known at that place; it was 9.5 inches above the high-water mark of 1874, and 7 inches above the stage of the 12th. The banks of the river fronting New Orleans were overflowed, and the water flooded the streets until 11 p. m., without, however, causing material damage. After this date the river at New Orleans continued nearly stationary between 16.5 and 16.9 feet until the 21st, after which it fell very slowly until the 31st, when the gauge readings were 15.9 to 16 feet.

At 10 p. m. of the 13th a crevasse one hundred and fifty feet wide occurred at Nita Plantation, 62 miles above New Orleans, La., which widened to six hundred and fifty feet by the close of the month. Twenty feet of levee gave way at Plattenville, on the east bank of Bayou La Fourche, and the levee broke at Mayersville, Miss., about sixty-six miles above Vicksburg. At Memphis, Tenn., the gauge reading was 36.5, feet, 0.1 foot higher than ever before reported at that place, and the river was reported fifty miles wide in many places between Memphis and Cairo, and at Vicksburg, Miss., the stage of the water was 47.6 feet and rising. On the 14th the Mississippi was rising from Memphis to the Gulf; a break one hundred feet wide occurred in the levee on the east bank of the river twelve miles below Donaldsonville, Saint James Parish, La., and the levee broke at Bohemia, south of New Orleans. Newport, Ark., was flooded, and about 75,000 acres of cultivated land in the adjacent county were under water. The White and Black rivers were falling. At Memphis the stage of the water was 36.4 feet and rising; at Helena, Ark., 44.1 feet and rising; at Vicksburg, Miss., 47.8 feet and rising; at Natchez, Miss., 46.5 feet; at Red River Landing, La., 44.7 feet; at Baton Rouge, La., 35.2 feet; and at New Orleans, 16.5 feet and rising. At Memphis, Tenn., the river reached an extreme height of 36.6 feet on this date, the highest water on record at that place, and the whole country on the Arkansas side of the river from Memphis, Tenn., to Helena, Ark., was reported submerged. On the 15th a crevasse occurred at Pecan Grove, La., about thirty-three miles above Vicksburg, and overflowed portions of East Carroll and Madison Parishes, and large tracts of land southward to the Red River. This was the largest crevasse that occurred during the month, being fully fifteen hundred feet wide. On this date the stage of water at Helena was 44.2 feet, and rising; at Vicksburg, 48 feet and rising; at Natchez, Miss., 46.9 feet; at Red River Landing, La., 44.9 feet; at Baton Rouge, La., 35.2 feet; and at New Orleans, 16.6 feet and rising. On the 16th the river began to fall at Vicksburg, the gauge reading being 47.6 feet; at Cairo the stage of the water was 48.3 feet, a rise of 0.1 of a foot; the Ohio River fell 0.6 of a foot at Paducah, Ky.; at Memphis the river was stationary at 36.6, and the backwater along Wolf River and Bayou Gayoso spread over considerable territory; at New Orleans the stage of the water was 16.7 feet and rising; at Natchez, Miss., 46.9 feet; at Red River Landing, La., 45.0 feet; and at Baton Rouge, La., 35.4 feet. On the 17th the stage of water at Memphis was 36.6 feet and falling; at Arkansas City, 48.6 feet; at Vicksburg, 47.7 feet and falling; at Natchez, Miss., 46.7 feet; at Red River Landing, La., 45.1 feet; at Baton Rouge, La., 35.4 feet, and at New Orleans, La., 16.5 feet and rising. On the 18th a crevasse occurred at Offutt,

Washington Co., Miss., about sixteen miles above Greenville, Miss. The gauge at Greenville read 43.5 feet on the 17th, and fell 0.3 of a foot by the 20th. A break also occurred at Luna, Ark., about thirty miles below Arkansas City. The water ran through what is known as Boeuf Cut Off, and the water rose steadily at Girard, La., on the Boeuf River. On this date the stage of water at Memphis was 36.4 feet and falling; at Helena, Ark., 44.5 feet and rising; at Arkansas City, 48.7 feet; at Vicksburg, 47.5 feet and falling; at Natchez, Miss., 46.4 feet; at Red River Landing, La., 45.1 feet; at Baton Rouge, La., 35.4 feet; and at New Orleans, La., 16.6 feet and rising.

On the 20th the levee broke at Jesuit Bend, Plaquemine Parish, La., at 1 a. m. The stage of the river at Memphis was 36.4 and falling; at Arkansas City 48.7 feet; at Helena 44.9 feet and rising; at Vicksburg 47.2 feet and falling; at Natchez, Miss., 46.2 feet; at Red River Landing, La., 45.1 feet; at Baton Rouge, La., 35.3 feet; and at New Orleans 16.6 feet and steady. On the 25th the levee broke about one and one-half miles above Arkansas City, the break being one hundred and fifty feet wide. The gauge reading at Arkansas City was 49.05 on this date, and the river fell 0.4 foot in three days. The stage of the water at Memphis on the 25th was 36.6 and rising; at Helena, 46.7 and rising; at Vicksburg 46.9 and falling; at Natchez, Miss., 45.8 feet; at Red River Landing, La., 45.0 feet; at Baton Rouge, La., 35.1 feet; and at New Orleans 16.2 feet and falling. On the 26th the levee broke at Skipwith, sixty miles above Vicksburg, the break being six hundred feet wide, and a break occurred at Live Oak, twenty-six miles below New Orleans, which widened on the 27th. On this date the stage of the water was 36.4 and falling at Memphis; 49.22 feet at Arkansas City and rising; 47.1 feet at Helena and rising; 46.8 feet at Vicksburg and falling; at Natchez, Miss., 45.8 feet; Red River Landing, La., 45.0 feet; Baton Rouge, La., 35.0 feet; and 16.2 feet at New Orleans and stationary. On the 27th a break occurred in the levee at Laconia, sixty-five miles above Arkansas City. At Helena the stage of the water was 47.4, only 0.7 foot below the highest water ever reached, and the river had risen 2.0 feet in ten days. At Arkansas City the river was 2.2 feet above the high water of 1884. At Memphis the stage of water was 36.6 feet and rising; at Vicksburg 46.7 feet and falling; at Natchez, Miss., 45.8 feet; at Red River Landing, La., 45.0 feet; at Baton Rouge, La., 34.9 feet; and at New Orleans 16.2 feet and stationary. On the 28th a crevasse three hundred feet wide occurred at Columbia, Ark., about thirty-one miles below Arkansas City, and a crevasse three hundred feet wide at Easton, Miss., four miles above Arkansas City, and a crevasse two hundred and fifty feet wide occurred at Huntington, Miss. On this date the stage of water at Memphis was 36.6 feet and stationary; at Helena 47.6 feet and rising; at Vicksburg 46.6 feet and falling; at Natchez, Miss., 45.8 feet; at Red River Landing, Miss., 45.0 feet; at Baton Rouge, La., 34.9 feet; and at New Orleans, 16.1 feet and falling. On the 29th the stage of the river at Memphis was 36.4 feet and falling; at Arkansas City, Ark., 48.8 feet; at Helena, 47.7 feet and rising; at Vicksburg, 46.6 feet and stationary; at Natchez, Miss., 45.6 feet; at Red River Landing, La., 45.0 feet; at Baton Rouge, La., 34.9 feet; and at New Orleans, 16.1 feet and stationary. On the 30th the levee broke at Austin, Miss., fifty-eight miles below Memphis. On this date the stage of the water at Memphis, Tenn., was 36.2 feet and falling; at Arkansas City, 48.7 feet and falling; at Helena, Ark., 47.7 feet; at Vicksburg, Miss., 46.4 feet and falling; at Natchez, Miss., 45.5 feet; at Red River Landing, La., 45.0 feet; at Baton Rouge, La., 34.8 feet; and at New Orleans, 15.9 feet and falling. On the 31st the protection levee at Greenville, Miss., gave way and the lower part of the town was inundated. The Ohio River was rising at Cairo, and the Mississippi River began to rise at Memphis, owing to the flood from the Ohio River. On this date the stage of the river at Memphis was 36.2 feet; at Arkansas City, 48.5 feet and falling; at Helena, 47.6 feet and falling; at Vicksburg, 46.3 feet and falling; at Natchez, Miss., 45.5 feet; at Red

River Landing, La., 44.9 feet; at Baton Rouge, La., 34.8 feet, and at New Orleans, 15.9 feet and falling.

The Signal Service observer at Memphis, Tenn., reports that the changes in the stage of the water at Cairo, Ill., were felt at Memphis in about sixty hours, a rise of 2.35 feet at Cairo being followed by a rise of 1.0 foot at Memphis. The Signal Service observer at Vicksburg, Miss., reports that, excluding Austin crevasse, the crevasses on the Mississippi side flooded the greater part of Washington, Sharkey, and Issaquena counties, and portions of Bolivar and Sunflower counties, and that, while the damage to property and stock was very great, no estimate of the losses could be formed at the close of the month. The Signal Service observer at New Orleans, La., reports that the damage from the Nita crevasse was great. The Mississippi Valley Railroad property at that point was submerged, and great damage was done to the cane crop. About three-fourths of the water from the Nita crevasse found its way into Lake Pontchartrain through the passes at Manchac, one of which was about nine hundred feet and the other about twenty-four hundred feet wide, with an average depth in both of about ten feet. Most of the plantations suffering were those fronting on the river.

Along the Ohio River and its tributaries flood conditions prevailed throughout the month; houses, barns, etc., in low lying districts were washed away; railroad and river traffic was interrupted, and bottom lands were flooded, causing heavy losses and much suffering. At Cincinnati, Ohio, the river rose very rapidly to a maximum height of 59.2 feet from 11 p. m. of the 25th to 4 a. m. of the 26th, the highest point reached since February, 1884, when the stage of the water was 71 feet.

At the close of the month the outlook in the lower Mississippi valley was discouraging. In addition to the danger and damage feared from water, the stock left in the valleys were being tortured by the regular attendant of high water, the Buffalo gnat. The Ohio and Mississippi rivers were generally falling, except at Cairo, Ill., where the river was rising, and at New Orleans, La., where the river was stationary. The water was 1.6 foot above the danger-line at Cincinnati, Ohio; 7.7 feet above at Louisville, Ky.; 6.6 above at Paducah, Ky.; 8.1 above at Cairo, Ill.; 0.4 above at Memphis, Tenn.; 10.6 above at Helena, Ark.; 5.3 above at Vicksburg, Miss.; and 2.9 above at New Orleans, La.

#### OPENING OF NAVIGATION.

**Lake Ontario.**—A schooner arrived at Oswego, N. Y., on the 24th; this was the first arrival of the season at that port.

**Lake Erie.**—A steamer left Toledo, Ohio, for Erie, Pa., on the 24th; this was the first departure of the season from Toledo. Several vessels left Sandusky, Ohio, on the 17th, opening navigation at that port for the season. A steamer left Cleveland, Ohio, for Detroit, Mich., on the 3d; this was the first departure of the season from that port. A propeller arrived at Buffalo, N. Y., from Toledo, Ohio, on the 31st; this was the first arrival of the season at Buffalo.

**Lake Huron.**—A schooner arrived at Port Huron, Mich., from Alpena, Mich., on the 23d; this was one of the earliest

passages on record. Navigation between Port Huron and Detroit, Mich., began for the season on the 24th, when the steamer "Ossifrage" resumed her trips. A steamer on her way to Alpena, Mich., touched at Port Huron on the 30th, and navigation on Lake Huron was considered open for the season on that date.

**Connecticut River.**—On the 13th there was considerable floating ice in the river at New London, Conn., but steamers were making regular trips.

**Hudson River.**—On the 20th a steamer arrived at Albany, from New York City; this was the first arrival of the season at Albany; and the boats of the Schuyler Towing Company were on their way up the river with their first tow of the season.

**Thunder Bay and Thunder River.**—The river and bay froze over on the 5th, closing navigation until the 31st, when a steamer arrived at Alpena, Mich., from Detroit, Mich. The steamer left for northern ports on the same date.

**Mississippi River.**—A steamer arrived at La Crosse, Wis., on the 31st; this was the first arrival of the season at that port. On the 19th the ice in the river at Dubuque, Iowa, broke, opening navigation at that point.

#### STAGE OF WATER IN RIVERS AND HARBORS.

The following table shows the danger-points at the several stations; the highest and lowest water during March, 1890, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, March, 1890 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<b>Red River:</b>						
Shreveport, La.....	29.9	22, 23, 24	28.0	1	21.4	6.6
<b>Arkansas River:</b>						
Fort Smith, Ark....	22.0	12	21.0	31	4.6	16.4
Little Rock, Ark....	23.0	14	22.3	11	9.6	12.7
<b>Missouri River:</b>						
St. Buford, N. Dak.*	21.0	22	9.3	1, 2	1.5	7.8
<b>Mississippi River:</b>						
Kansas City, Mo....	21.0	22	9.3	1, 2	1.5	7.8
Saint Paul, Minn....	14.5	28	3.0	13	1.8	1.2
La Crosse, Wis....	24.0	21	4.5	27	2.9	1.6
Dubuque, Iowa....	16.0	23, 24	4.5	31	3.6	0.9
Davenport, Iowa....	15.0	16	5.1	31	3.0	2.1
Keokuk, Iowa....	14.0	16	5.6	1	1.1	4.5
Saint Louis, Mo....	32.0	29	15.2	8	4.7	10.5
Cairo, Ill.....	40.0	12, 13	48.8	1	42.1	6.7
Memphis, Tenn....	34.0	14 to 17, 23 to 28	36.6	1	32.6	4.0
Vicksburg, Miss....	41.0	15, 16	48.0	1, 2, 3, 4, 31	46.3	1.7
New Orleans, La....	13.0	13	17.0	1, 2	15.5	1.5
<b>Ohio River:</b>						
Pittsburgh, Pa....	22.0	23	24.3	9	4.8	19.5
Parkersburg, W. Va.	38.0	25	35.0	10	8.4	26.6
Cincinnati, Ohio....	50.0	26	59.2	11	23.3	35.9
Louisville, Ky....	25.0	28	35.5	10	10.4	25.1
<b>Cumberland River:</b>						
Nashville, Tenn....	40.0	6	50.6	13	20.0	30.6
<b>Tennessee River:</b>						
Chattanooga, Tenn.	33.0	2	42.5	13	8.6	33.9
Knoxville, Tenn....	29.0	1	16.2	13	3.7	12.5
<b>Monongahela River:</b>						
Pittsburgh, Pa....	29.0	23	24.3	9	4.8	19.5
<b>Savannah River:</b>						
Augusta, Ga....	32.0	1	21.4	19, 20	8.0	13.4
<b>Willamette River:</b>						
Portland, Oregon....	15.0	9	9.0	1	0.3	8.7

\* Frozen.

#### ATMOSPHERIC ELECTRICITY.

##### AURORAS.

Fort Buford, N. Dak.: an aurora was first observed at 9.55 p. m., 15th. It consisted of a well-defined arch of a light gray color of about 2° in width which rose to about altitude 25°, and extended over about 80° of the horizon, between northwest and northeast. No material changes occurred from the time it was first observed until it suddenly disappeared about 10.30 p. m. The display reappeared about 11.08 p. m., with characteristics and colors as before described, and continued so until near midnight.

Saint Vincent, Minn.: a remarkably brilliant aurora, extending from northwest to northeast, was observed from 9.45

p. m. until midnight on the 13th. It first appeared as a pale, diffused, whitish light, but soon changed to an orange color; six well-defined streamers shot up to altitude about 40° above the northern horizon. The display was perfect, and was characterized by recurring fits of brilliancy. A faint aurora was observed from 9.30 to 11.15 p. m., 22d; it was of a pale yellow color, and rose to about 15° above the horizon, and extended from azimuth 160° to 195°. During the last stage of the display it changed to a dull diffused light, which suddenly faded away. Auroral lights were also observed at this place on the 12th and 16th.

Auroras were observed during the month as follows: 3d,